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AUTHOR Jones, Zipporah
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ABSTRACT

A study investigated whether statistically significant differences in reading achievement developed after an exposure to the Writing to Read (WTR) program. Subjects were 15 third-grade students from a 100% minority population elementary school on Chicago's west side who were exposed to the Writing to Read program and 15 students from the same school who were not exposed to the program. Subjects' reading scores of the Iowa Tests of Basic Skills were used as pre- and posttests. Results indicated: (1) no statistical differences existed between the groups at the beginning or at the end of the treatment period; and (2) although differences in reading scores were not statistically significant at the 0.05 level, the WTR program group had a greater mean gain than the control group's mean gain. (Contains 1 table of data and 19 references.) (RS)

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WRITING TO READ: COMPUTER-ASSISTED INSTRUCTION AND READING ACHIEVEMENT

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Although the computer is a frequent classroom companion, not much evidence is available of its benefits in raising the Iowa Test of Basic Skills (ITBS) scores of students. The expected benefits for computer assisted instruction, where the interaction between the computer and the student, with the computer adjusting to every response, would be expected to rival those of a personal tutor. But is this the case? There is little conclusive evidence on the benefits derived from the increased proliferation of the computer and technology in the classroom. Becker (1987) conducted a "best evidence analysis" of the empirical research on the effects of computer-based approaches in learning, and concluded that existing evidence of computer effectiveness is scanty. He stressed the need for further research to compare computer and traditional instructional approaches.

It is important to determine if benefits accrue to the students by reason of the proliferation of computers and to add to the available knowledge of these benefits. Choices must be made about programs and knowledge to be transmitted and their value to the student and to society. Information is needed on the effectiveness of the integration of hardware, software, programs and applications for which computers are used. Information is needed on the benefits of computer instruction in varied areas, grade levels, and student populations in order to take full advantage of whatever benefits exist.

Accurate indicators would help suppress the temptation to invest in technology for technology's sake or to appear on the cutting edge. Decisions must be rational and

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expenditures must be justified by results. The proper information will help Local School Councils, administrators, teachers and parents make the best decisions about the use of funds and about the education of their children.

Although research on Computer-assisted instruction (CAI) has not been conclusive, the proliferation of computers in the elementary classroom continues at a feverish pace. Ninety-eight percent of elementary and secondary schools in the United States have microcomputers. Ten percent of schools have 1 to 9 students per computer; thirty percent have 10 to 19 students per computer; twenty percent have 20 to 30 students per computer; thirteen percent have 30 to 44 students per computer; and twenty-eight percent have 45 or more students per computer (Quality Educational Data, 1992).

Computer-based instruction has had minimal, measurable impact on learning achievement. By any method of learning achievement, or significant changes in styles of teaching and learning, or of curriculum reform, the conclusion is "little or no effect." A recent meta-analysis of 184 studies that examined the effects of computer-assisted instruction reports an overall effect size of .32 standard deviation for the learning technologies over traditional instruction (MERC, 1993). While this is positive evidence in favor of computers in education, it does not realize the potential promised by proponents of computer based instruction (Hawkridge, et. al. 1990).

The reason for educational computing then, must be justified, rationalized in other ways. Hawkridge (1990) cited four basic rationales for the proliferation of computers in schools:

Social rationale - Policy makers want to be sure that all children should be...aware, unafraid of how computers work. Learners should be prepared to understand computers and be aware of their role in society.

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Vocational rationale - Learning to operate computers is an important competency. Teaching children...may be a foundation for careers in Computer Science.

Pedagogic rationale - Students can learn more from computers. Computers can teach. There are advantages to using computers over other traditional methods.

Catalytic rationale - Schools can be changed for the better by the introduction of computers. Computers become a facilitating factor to bring about change. They are symbols of progress. They encourage learning. Computers are seen as catalysts, enabling desired change in education to occur.

The rapid and extensive proliferation of computers in schools reinforces the notion that computers are symbols of "modern" schools and that awareness of computers will confirm the fact that schools are up-to-date. This along with the cultural perspective that basic computer literacy is a fundamental requirement for participation in the society of tomorrow, and using a computer develops more generalized intellectual abilities.

The objective of this study is to compare the reading achievement of low-achieving third grade students who participated in IBM's Writing-To-Read (WTR) program with low achieving student who did not. WTR is a computer-based instructional system designed by John Henry Martin[1] to develop writing and reading skills of kindergarten and first-grade students. The WTR program student selection was based on reading scores as measured by Iowa Test of Basic Skills (ITBS). Low achieving students are defined as students achieving at stanine 1, 2, 3 or students receiving full-time instruction in an ESEA classroom. The Elementary And Secondary Education Act (ESEA) provides supplemental funds for educational opportunities for low income students. The WTR center and interrelated learning stations are contained in the regular classroom and provide interaction, guidance, and command of the computer for students to direct their own learning. The teacher is the instructional supervisor.

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[1] IBM Literature

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Fitzpatrick (1991) said that the teacher is the most important variable in CAI. Computers challenge teachers to learn a new technology and also to act as learner and teacher at the same time. Teachers are challenged to experiment as they learn to use computers and determine how to best integrate CAI into the curriculum. While schools have made progress in their effort to train teachers in the use of instructional technology, many teachers remain unfamiliar and uncomfortable with computers and the technology. Apple (1992) noted research indicating that few teachers are given substantial information or training before computer curricula are implemented. Kearsey, et. al. (1992) accuses schools of failing to provide adequate training--enough or the right kind--the time and hands-on practice to properly learn a system is often overlooked or is too minimal.

Hawkridge (1990) noted that when computers are used in schools it is to learn selected topics from the school's curriculum, with the computer and educational software either complementing or temporarily replacing the teacher. They are used to enrich the existing curriculum and improve the way in which it is delivered, by using computers as sophisticated educational tools which can extend traditional ways of presenting information to children and offer new opportunities through techniques possible only with computers. The addition of microcomputers in the school helps young people explore new technologies through which future ideas will be communicated. The computer permits interaction almost instantly, putting students in decision making positions, in control of endless amounts of information, and with tremendous power in their hands.

Recent survey data showed most elementary students use computers, mainly occasionally and for purposes of lending variety and enrichment, rather than as a central component of teacher instructional program Expectations persist for CAI to be effective in helping to improve student academic performance. Computer-based activities are motivational; the clearest empirical research that exist about instructional uses of computers is that students overwhelmingly enjoy most computer learning activities.

Computer education can provide the opportunity to address and enhance the fundamental goals of schooling--including basic skill development, equality of opportunity and the realization of human potential. But Apple (1992) discussed other social implications of computers in schools. He suggested that the schools are being turned into "production plants" and that we must be very certain that the new technology will benefit all of us. The introduction of computer technology may increase already wide social imbalances. Private schools and public schools in affluent areas will have more access to computers and technology. Poorer schools will be priced out of the market. Computers and computer literacy will "naturally" generate further inequalities. We may be affixing one more label to students..."functional illiteracy" will be broadened to include computers.

The growing availability and use of computers in education has prompted researchers to look for measurable effects of computer-assisted learning on testable outcomes. Baird and Silvern (1992) attempted to determine if there were effects associated with learning in one mode and testing in another; or test validit, in assessing computer learning. A meta-analysis of 54 studies by Kulik, Kulik and Cohen (1980) uncovered and effect size for computer-based instruction that ranged from -1 to almost +3 on achievement. Thirty-seven of the 54 studies favored computer-based instruction while 17 favored conventional instruction. The study did not examine type of test used to assess targeted learning. Many variables may interact, which makes definite conclusions on effect of computer instruction difficult. Clark (1983) noted some explanations for the conflicting results, such as variance in teaching styles and applications of the computer, types of supplementary materials used in computer learning, and prior knowledge of the learner.

Baird and Silvern (1992) also determined that the post treatment assessment of learning may represent an uncontrolled variable in research on computer learning. Most reported results of interactive CAI are based on pencil and paper assessments. These studies assume the pencil and paper

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assessments are valid indicators of learning presented through a medium which does not use paper and pencil. Kirby (1979) pointed out that traditional schooling, with its emphasis on print material for both learning and assessment, is biased in favor of learners with field independent, reflective learning styles. Such students may test higher than their field-dependent, impulsive classmates. Current software is characterized by high levels of interaction between the learner and the learning environment. The difference between a computer environment and the regular school environment suggest that assessment of computer learning should be done on a computer. This raises the question of whether computer augmented learning can be effectively measured using static print formats.

Robinson & Cooper (1990) studied students in an English composition class. Half of the students were assigned to using the computer and half to using pen and paper to write course assignments. Analysis of the final essays revealed that those subjects assigned to use computers wrote better essays than those assigned to work on paper. There was a significant performance difference. Students in the computer section received higher scores on their essays (M=5.8) than did students in non-computer section (M=5.1). Grades given by teachers showed the same results. Students using computers were given grades of (M=7.8) and students who wrote by hand were given grades of (M=6.9). Other differences were noted. Essays written on computers contained fewer punctuation errors (M=0.05) than did handwritten essays (M=0.31). Computer generated work contained more words (M=364.5) than handwritten work (M=297.4); average sentence length (M=18.9) for the computer generated work to (M=17.0) for the handwritten work; greater number of complex sentences (M=8.4 for computer generated and (M=6.8) for handwritten. As measured by performance scores, class grades, punctuation errors, number of words, sentence length and number of complex sentences, the students who worked on computers wrote better (Robinson, Staveley, et. al. 1990).

Becker (1992) was critical of research which reported score gains for hundreds of students in two Chicago Public Schools. The positive effect sizes in those schools are

based not on substantial year-to-year gains during CAI years but on extremely low gai s during prior (comparison) years. At these two schools, students gained an average of about 7/10 to 3/4 of a grade equivalent per year prior to their use of computers, a level typical of inner-city schools. But in pre-computer years, students gained only about 4/10 of a grade equivalent per ye r, a level lower than likely to exist at any other regular public school in the country with normal test administration and scoring conditions (Becker, 1992).

Arroyo (1992) studied the results of Extensive Computer instruction (ECI) on inner-city seventh grade students. Computers were situated in the "homeroom" and could be used in all subject areas. She cites a number of studies that suggest there is potential for improvement or improvement in achievement when CAI is used in the classroom. The findings from her research show a significant gain, as shown by the t scores of (0.307) for 1991 and (3.5)for 1992 of the experimental over the control group.

Collis, et. al. (1990) conducted a study of WTR in two British Columbia schools from 1985 through 1987. They encountered difficulties in comparing the non randomly selected sample of int c WTR classes with other classes and commenting on the impact of WTR experience on achievement. Data accumulated over a six year period before WTR was implemented was analyzed Grade one students in the years prior to WTR were compared with students after a full year of implementation of WTR. The data compared student achievement in the same school, with the same teachers before and after the WTR program. The comparison of the two groups were not significantly different in terms of reading achievement. WTR appears to be associated with an improvement in some aspects of writing for grade one children but does not appear to be associated with any "signi icant" improvement in reading when compared to "traditional" classrooms. It was suggested that a closer scrutiny of the WTR system from more than the criteria of achievement scores is needed (Collis, et. al. 1990).

Leahy (1991) did a multi-year evaluation of the WTR program between schools in a mid-sized suburban district.

The study compared second grade students, who had received WTR in first grade, in schools implementing WTR with second grade students receiving "traditional" instruction in schools not implementing the program. The reading and language arts section of the Comprehensive Test of Basic Skills (CTBS) and a Competency Based Writing Sample were the instruments of comparison. Statistically significant differences at the 0.05 level were found on all subtests between the WTR and NWTR students. Leahy also noted statistically significant gender differences between WTR and NWTR scores on the CTBS. The average word count for the Competency Based Writing Sample was not statistically significant when the WTR and NWTR students were compared. However, the average number of words produced by second graders did show a statistically significant difference when related to the sex of the student in WTR and NWTR groups. The average word count by WTR males was 61.46 words and NWTR males had a mean of 49.72 words, while WTR females produced 70.01 words on an average compared to 64.9 words for NWTR females (Leahy, 1991). Leahy thought that the use of a commercial program (WTR) represented a confounding variable by its early emphasis on structure. The teacher's role in integrating computer instruction effectively with the reading program was seen as a weakness. In the WTR program the integration is structured into the program and not left up to the teacher who is trained to observe the readiness for interaction and progression. The teacher is the most important variable in reading instruction (Leahy, 1991).

The jury is still out on the benefits derived from CAI; it has not lived up to expectations, but maybe expectations were too high. Indicators, though, point to positive benefits for students and teachers. More and more research shows some measurable gains in achievement and many more positive influences on affective student behaviors. CAI can serve to increase student interest and motivation to learn; offer enjoyment, enrichment and variety to the curriculum while it introduces students to a "new" technology. CAI can help to increase teacher effectiveness by being an available, on-going classroom resource; and providing more time for the teacher to assist, encourage and guide students. For the school and the classroom, CAI can offer renewed enthusiasm

for learning, curriculum reform, individualized instruction, and computer literacy.

In conclusion, Ely (1993) put it best when he concluded that where deliberate efforts have been made by teachers or schools, one would have to say, the teachers and the learners will never be the same. They have gained new skills, new perceptions of how to learn; increased motivation, and renewed enthusiasm for teaching and learning. Justification for computer learning is often sought in research findings that "prove" their value in acquisition of knowledge as tested by traditional means. Perhaps there are other measures of success that have not been tested or are beyond testing such as attitudes toward learning, willingness to pursue problems until they are solved, and changing of the teacher from a presenter of information to a facilitator of learning. Perhaps the "right" research questions have not been raised (Ely, 1993).

Procedures

Population:

The population for this study will include 60 third grade students at the Laura S. Ward Elementary School. Laura S. Ward School is located in a predominantly low socioeconomic neighborhood on Chicago's west side, in the Garfield Park community. The school's population is defined by the State as being 93% low income. The schools' population is comprised of 99.1% African-American and 100% minority students.

From the sixty students who were in third grade in the 1992-1993 school year, thirty were selected. Fifteen who had received WTR computer-assisted instruction and fifteen who had not. Only those students whose pretest ITBS scores had stanine 1, 2 or 3 were selected.

Each spring the Iowa Tests of Basic Skills (ITBS) is administered to each student in Chicago's Public Elementary Schools. Two samples were identified from school records from those students who had participated in the WTR program and those who had not. The pretest-posttest group design will be utilized The reading scores of the ITBS administered in the Spring 1992 will be used as pretest and reading scores of ITBS administered in Spring 1993 will be used as posttest.

Treatment of Data:

The findings were tabulated in terms of means and standard deviations. The t test will be employed at the .05 level of confidence to determine if there is any statistically significant difference between the mean scores.

Findings of the Study

The samples for the study included third grade students of Laura Ward Elementary School. Each Spring students take the ITBS. From these third grade students, two groups were selected. Students in one group had received classroom WTR computer-assisted instruction while students in the other group had not. Students in both groups had stanines of 1, 2 or 3. Results from the 1992 ITBS reading subtest was used as a pretest and results from the 1993 ITBS reading subtest was used as a posttest. A t test ($p > .05$) for independent samples was done on the two sets of scores to determine if there was a statistically significant change in reading achievement after exposure to the WTR program. Table 1 summarizes the statistical analyses. Although pre and post writing samples were not a part of a critical skill analysis, they are included for showing skill acquisition by using the WTR program. Sample 1 (pre), and sample 2 (post).

Table 1

Means, Standard Deviations, and t Tests for the WTR group and the Control group for Reading Achievement Scores (N=15)

Test	WTR	Control	t
Pretest			
M	1.42	1.57	1.4090
SD	0.2835	0.4958	
Posttest			
M	2.33	2.20	
SD	0.3978	0.6164	0.6871

*significant at the 0.05 level $p > .05$

Analysis of the 1992 mean pretest scores indicate that no statistical significant difference existed between the groups at the beginning. The WTR group had a mean of 1.42 and the

Control group a mean of 1.57 as measured by the reading subtest of the ITBS. Analysis of the 1993 mean posttest scores permits the conclusion that there was no statistical significant difference between the two groups in reading in Spring 1993. The WTR group had a mean of 2.33 and the control group a mean of 2.20.

Although the difference is not significant at the .05 level, examination of the data reveals that after one year exposure to the WTR program that group had a greater mean gain (0.91) when compared to the control group mean gain (0.63). The control group pretest mean was 0.15 higher than the WTR group; the WTR group posttest mean was 0.13 higher than the control group. The WTR group made greater overall gains than the control group. Although assessments of writing skills were not included in the measurement that may provide a clearer indication of the benefits resulting from WTR. Writing samples 1 and 2 are examples of the skills not measurable by the reading subtest, but of the affective domain that provide satisfaction and benefit to the student.

Overall, the data leads to the acceptance of the null hypotheses: that low-achieving third grade students receiving WTR instruction will not achieve significantly greater gains on the ITBS reading subtest than third grade students receiving regular instruction. The research hypothesis was not supported.

The examination of ITBS subtest differences needs more study over a longer time. Formal analyses of pre and post writing samples may also offer some research options. Ethnic, socioeconomic and gender differences provide the basis for other types of data analysis.

More follow-up research is needed with students participating in WTR and with instruments designed to properly assess learning in the CAI environment. Paper and pencil assessments may not be valid assessors of the skills gained in the CAI environment. Perhaps the benefits to the students are not in measurable terms but in unintended educational outcomes that are as important as the intended ones. Unintended outcomes of renewed enthusiasm and increased motivation to explore, express, and experiment with creative ideas and cognitive processes; and the possibility for enhancing growth in problem-solving, decision-making and intellectual abilities are the behaviors that need to be measured.

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